

## **CLAIMS**

### **What is claimed is:**

1. A supercharger, comprising:  
a shaft having an axis of rotation;  
a first supercharger housing element; and  
a second supercharger housing element;  
wherein the first and second supercharger housing elements meet at a location that is substantially parallel to the shaft axis of rotation.
2. The supercharger of claim 1, wherein the location is substantially coplanar with the axis of rotation of a driveshaft or an impeller shaft.
3. The supercharger of claim 1, wherein the location is selected from a group consisting of: a substantially flat plane formed between the first and second supercharger housing elements, a substantially flat surface formed between the first and second supercharger housing elements, a stepped surface formed between the first and second supercharger housing elements, and an irregular surface formed between the first and second supercharger housing elements.

4. The supercharger of claim 1, wherein between the first and second supercharger housing elements include semicircular recesses that provide an opening in the supercharger dimensioned to receive the shaft.
5. The supercharger of claim 1, further comprising a lubrication reservoir disposed within the supercharger.
6. The supercharger of claim 5, wherein the lubrication reservoir is separate and detachable.
7. The supercharger of claim 5, wherein the lubrication reservoir includes a heat transfer element.
8. A supercharger, comprising:
  - a rotatable shaft;
  - at least one bearing assembly disposed around a portion of the rotatable shaft;
  - a housing element surrounding the bearing assembly; and
  - an intermediate member disposed between the bearing assembly and the housing element.
9. The supercharger of claim 8, wherein the intermediate member comprises a ferrous-based material.

10. The supercharger of claim 9, wherein the ferrous-based material is selected from a group consisting of: a gray iron, a G2-grade gray iron, a DURA-BAR, a free machining steel, a 12L14 steel, a 1018 steel, a ferrous based iron, a steel, and a steel alloy.
11. The supercharger of claim 8, wherein:  
the bearing assembly has a predetermined coefficient of thermal expansion; and  
the intermediate member has a coefficient of thermal expansion that is  
substantially similar to the coefficient of thermal expansion of the bearing assembly.
12. The supercharger of claim 8, wherein the intermediate member has a coefficient of thermal expansion that may range between about 0.000004 and 0.000007 in/in-°F.
13. The supercharger of claim 8, wherein the intermediate member is selected from a group consisting of: a sleeve, a sheath, a single element, and more than one element.
14. The supercharger of claim 8, wherein the housing element is comprised of aluminum.
15. The supercharger of claim 8, wherein the intermediate member is substantially cylindrical.
16. The supercharger of claim 8, wherein the rotatable shaft, bearing assembly, and intermediate member comprise a replaceable cartridge assembly.

17. The supercharger of claim 8, wherein the bearing assembly comprises at least two spring pre-loaded bearing sets.
18. The supercharger of claim 8, wherein the bearing assembly comprises at least two substantially rigidly preloaded bearing sets.
19. A supercharger comprising:
  - an impeller;
  - a drive gear coupled to the supercharger; and
  - a disengagement device disposed between the impeller and the drive gear;wherein the disengagement device permits disengagement between the impeller and the drive gear.
20. The supercharger of claim 19, wherein the impeller is disengaged from the drive gear during deceleration.
21. The supercharger of claim 19, wherein the disengagement device comprises a one-way clutch.
22. The supercharger of claim 19; wherein the disengagement device is coupled to the drive gear.

23. The supercharger of claim 19, wherein the disengagement device is a sprag or overrunning clutch.

24. The supercharger of claim 19, wherein the disengagement device comprises a speed-sensitive mechanism.

25. The supercharger of claim 19, wherein the disengagement device comprises a centrifugal clutch.

26. The supercharger of claim 19, wherein the disengagement device comprises both a speed-sensitive mechanism and an over-running mechanism.

27. A supercharger, comprising:  
an impeller shaft;  
an impeller coupled to the impeller shaft;  
at least one bearing assembly positioned around a portion of the impeller shaft;  
and  
a spacer assembly positioned between the impeller and the bearing assembly.

28. The supercharger of claim 27, wherein the spacer assembly comprises a tubular spacer positioned around a portion of the impeller shaft.

29. The supercharger of claim 28, wherein the spacer assembly further comprises an impeller spacer positioned adjacent to a base of the impeller.

30. The supercharger of claim 27, wherein the spacer assembly is structured to couple the impeller to the bearing assembly.

31. An impeller, comprising:  
a first set of blades having a first height;  
a second set of blades having a second height; and  
a third set of blades having a third height;  
wherein the first height is greater than the second height, and the second height is greater than the third height.

32. The impeller of claim 31, wherein the blades are disposed at substantially equal circumferential intervals about the impeller.

33. The impeller of claim 31, wherein the impeller further comprises a fourth set of blades having a fourth height, wherein the third height is greater than the fourth height.

34. The impeller of claim 31, wherein the impeller comprises an inlet region having a blade count that is less than the blade count of an outlet region.

35. The impeller of claim 34, wherein the blade count comprises a number of blades having a blade portion that extends into an impeller region.

36. A supercharger, comprising:  
a compressor housing, the compressor housing comprising at least three components.

37. The supercharger of claim 36, wherein the at least three components are selected from a group consisting of: a main housing, a shroud and a diffuser.

38. The supercharger of claim 36, wherein the at least three components are manufactured separately.

39. The supercharger of claim 36, wherein the at least three components are coupled together by force-fit or friction-fit.

40. The supercharger of claim 36, wherein the at least three components comprise a curved diffuser passageway, with a curvature ranging between about 20° to about 60°, in the axial direction.